Integrating Mechanical and Cultural Control Treatments to Manage the Invasive Shrub *Chromolaena odorata* in Grassland Areas

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Introduction

Chromolaena odorata (L.) King and H. Robinson, is a major invasive weed of pastures and plantation crops in many countries and has become one of the worst invasive plants in grassland areas in Indonesia. *Chromolaena* can grow rapidly and form infestations that can suppress pasture by competing for nutrients and water, and by over-shading. Its allelopathic effect lowers productivity of desirable forage species with a concomitant loss of livestock production. *Chromolaena* leaves, especially when young, are toxic to animals due to high levels of nitrate (5 - 6 times above toxic level) (Sajise 1974).

Control of *Chromolaena* is difficult due to its ability to thrive in a wide variety of soils, rapid attainment of reproductive maturity, large production of easily dispersed seed and a strong ability to resprout after burning (Witkowsky and Wilson 2001). The present experiment was conducted to evaluate the efficacy of integrating mechanical and cultural control methods to suppress regrowth of *Chromolaena* and other weeds and to determine the influence of *Chromolaena* management on botanical composition.

Materials and Methods

This study was conducted during the dry season in a grassland in South Sulawesi, from July to November 2012. The treatments were: T1 slashing of *Chromolaena* every month, T2 digging up of *Chromolaena* and left on the soil surface (mulching), T3 digging up of *Chromolaena* followed by burning, T4 digging up of *Chromoalena* followed by burning and sowing with *Centrosema pubescens*, and T5 digging up of *Chromolaena* followed by burning and planting with *Brachiaria decumbens*. Efficacy of treatments was measured by dry weight of weeds produced. The experiment was conducted in plots measuring 5.0 x 5.0 m, with all treatments replicated three times.

Results and Discussion

The dry yield of dominant plants during the study are shown in Table 1. Dry yield of *Chromolaena* after digging up integrated with other treatments was negligible, but dry yield of other weeds increased. This indicates that digging up is more effective in controlling regrowth of *Chromolaena* but not other weeds. The negligible regrowth of *Chromolaena* in this study may be attributed to the low germination of this weed as affected by a limited available water in the soil as most of this study occur in heavy drought in which total rainfall during the study (August to November) was only 259 mm. The low germination of *Chromolaena* seed during the dry season was also noted by McFayden (2003), although some seed appears to remain dormant for several years.

Burning of *Chromolaena* followed by planting with *Brachairia decumbens* was the most effective in suppressing of weeds. This is in line with Renrun and Xuejun (2012) in southern China who reported that in the first two years of establishment, *Brachiaria decumbens* in pasture effectively prevented germination and seedling growth

Table 1. Dominant species ranking based on dry matter yield (g/plot) (in parenthesis) every month after treatment.

	One		Two		Three	
T1	*Chromolaena*	(353.33)	*Stachytarpheta*	(1983.35)	*Stachytarpheta*	(1650)
	Stachytarpheta	(345)	*Chromolaena*	(1370)	*Borreria sp.*	(441.65)
	Total weeds	**(1081.65)**	**Total weeds**	**(6236.65)**	**Total weeds**	**(3095.02)**
T2	*Calopogonium*	(790)	*Stachytarpheta*	(1451.65)	*Stachytarpheta*	(1365.35)
	Stachytarpheta	(145)	*Calopogonium*	(740)	*Calopogonium*	(740)
	Total weeds	**(281.65)**	**Total weeds**	**(2261.65)**	**Total weeds**	**(1949.5)**
T3	*Mimosa*	(281.35)	*Mimosa*	(1803.35)	*Mimosa*	(1420)
	Stachytarpheta	(180)	*Stachytarpheta*	(561.33)	*Stachytarpheta*	(396.65)
	Total weeds	**(550)**	**Total weeds**	**(3195)**	**Total weeds**	**(2865)**
T4	*Mimosa*	(286.65)	*Mimosa*	(1803.35)	*Mimosa*	(1416.65)
	Centrosema	(215)	*Centrosema*	(875)	*Centrosema*	(395)
	Total weeds	**(555)**	**Total weeds**	**(4531.65)**	**Total weeds**	**(2176.2)**
T5	*Brachiaria*	(443.35)	*Brachiaria*	(3256.65)	*Brachiaria*	(4916.65)
	Mimosa	(148.35)	*Mimosa*	(328.35)	*Mimosa*	(493.35)
	Total weeds	**(308.33)**	**Total weeds**	**(836.67)**	**Total weeds**	**(1065)**

of *Chromolaena*. The high efficacy of *Brachiaria* may be attributed to the vigorous nature of *Brachiaria* growth and its ability to extract growth resources from the soil.

Botanical composition was shifted with treatments In monthly slashed plots the dominant plants were *Chromolaena* and *Stahytarpheta jamaicensis* and in mulched plots, the dominant species were *Calopogonium muconoides* and *Stachytarpheta*. In burnt plots, the dominant species was *Mimosa pudica*, indicating that burning stimulated germination and seedling growth of this plant. This is in line with reports of De Menezes and Rossi (2011) that burning of *Mimosa* seeds can kill surface seeds but not buried seeds and may stimulate seeds germination due to removal of seed coat. In contrast, in this study the botanical composition of *Stachytarpheta* in burnt plots was lower compared to that of unburnt plots. This may be attributed to destruction of *Sachytarpheta* seeds at the soil surface by burning, which is the optimum depth for germination and emergence (Diaz-Filho1996).

Conclusion

From this study, it can be concluded that digging out of *Chromolaena*, followed by burning and planting with *Brachiaria decumbens* is the most promising method to control this weed in grassland area. It needs further study how this grass can control this weed in the rainy season and how to manage this grass in order to get high animal production while continuing to control this weed.

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